Process Doctor

组装程序教育

The Downside of Selective Soldering

If not cleaned, pallets can leave harmful residues.

In the world of no-clean (low solids) flux, a unique wave solder pallet is used to isolate the solder to only through-hole interconnect locations. This protects the previously attached bottom-side SMT during a second reflow. Selective soldering solves an important attachment problem for large connectors and components that are not addressed by SMT packaging.

Another benefit of selective soldering is thermal protection of small components placed next to a through-hole component area. Under other processes small, low standoff capacitors and resistors tend to shift if heated enough to reflow their solder. Selective solder also eliminates the chipbonder gluing and curing steps prior to wave soldering and minimizes the number of lost or disturbed parts from the wave solder step.

Figure 1. Selective solder pallet with a board.

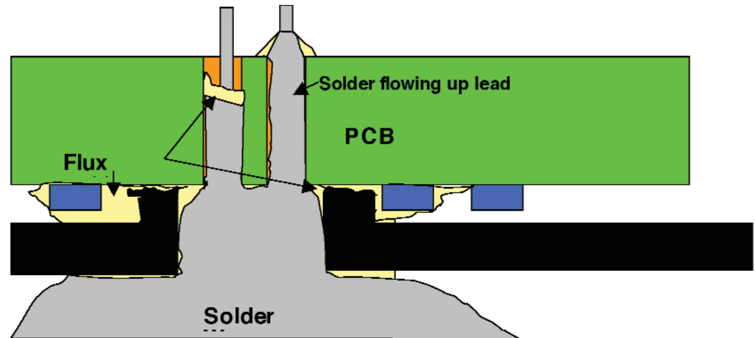

Figure 2. Detail of isolated area showing trapped flux.

But with all the apparent benefits on a selective soldering process, is there a downside to this widely adopted process? I believe there is.

The problem occurs when the solder is isolated to the opening of the pallet, but the flux is not. Typically the no-clean liquid flux is either spray or wave applied to the bottom side of the board. With the low surface tension of the IPA or water-based fluxes and the strength of capillary forces between the board surface and the pallet opening, an area 0.25" to 1.5" surrounding the selective pallet opening is exposed to fluxes, but not the wave solder. **Figure 1** shows a cross-sectional view of a selective solder pallet.

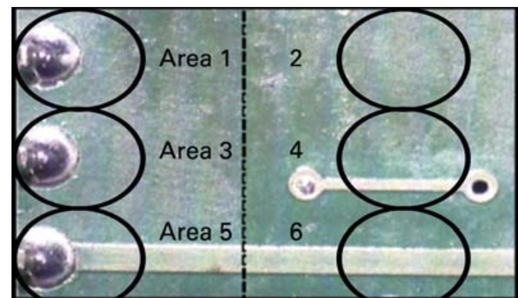

Figure 3. Areas 1, 3 and 5 (left) are inside the solder ring and show low WOA levels. Areas 2, 4 and 6 are outside the ring and show high WOA levels.

Table 1. Cleanliness Results

	Ion Chromatography Results per IPC-TM-650, 2.3.28				C3 Tester	
	Chloride	Bromide	Nitrate	WOA	Results	Time (sec.)
Area 1 (inside solder ring)	1.04	1.69	0.22	21.36	Clean	180
Area 2 (outside solder ring)	1.33	0.74	0.39	174.54	Dirty	12
Area 3 (inside solder ring)	1.05	1.35	0.18	22.08	Clean	180
Area 4 (outside solder ring)	1.18	0.48	0.42	169.95	Dirty	10
Area 5 (inside solder ring)	1.11	1.64	0.21	20.04	Clean	177
Area 6 (outside solder ring)	1.09	0.81	0.36	144.87	Dirty	16

All values in µg/in^2

Figure 2 illustrates how the flux is flowing between the pallet and board surfaces. The flux is trapped on the board surface and the pallet surface. Both areas are thermally protected and isolate the flux from the surface of the wave solder. The trapped flux residue is both conductive and moisture-absorbing. Water-based no-clean fluxes leave a residue with a pH of 2.3 (a strong acid) and are moisture-absorbing. This flux residue can cause electrochemical migration and thermal degradation on the surface of a biased assembly.

And the problem gets worse. Since the flux residue contaminates both the assembly and the pallet, and there is a general lack of in-house cleaning systems, the pallets will also add flux contaminants to the surface of the assembly from the previous soldering applications.

Figure 3 shows the spread effect of the flux in the

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selective solder pallet. The edge is defined by the ring effect and the spread is easily seen beyond that isolation ring. Areas 1, 3 and 5 (inside the solder ring) show low levels of WOA and good electrical performance based on C3 testing of the residues (**Table 1**, online). Areas 2, 4 and 6 (outside the solder ring) show a high level of WOA and poor electrical performance with the C3 tester.

Selective soldering has many benefits, but selective pallets will leave moisture-absorbing and conductive/corrosive residues if the material is not completely removed or heat activated.

When using a selective soldering process there are ways to complex the flux and create the benign flux residue promised by vendors. ■